British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

Assessment of the soil contribution to atmospheric particulates in the UK – Source apportionment monitoring over days years and decades

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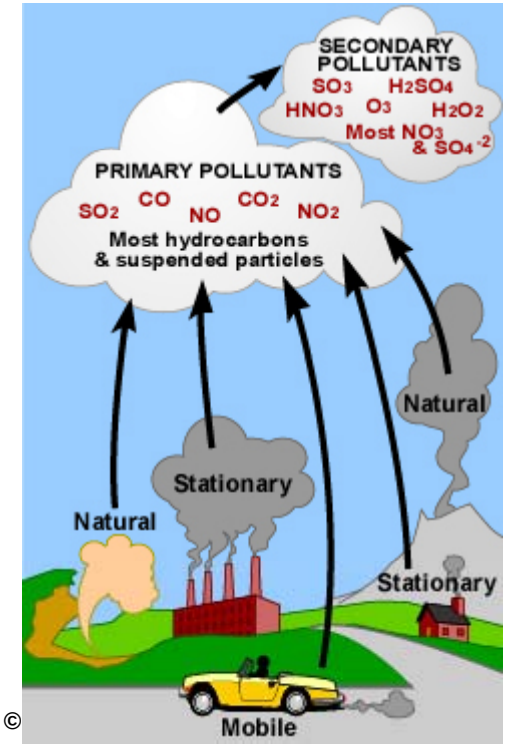
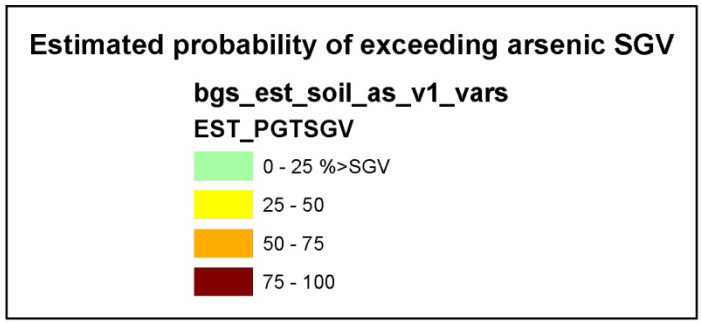
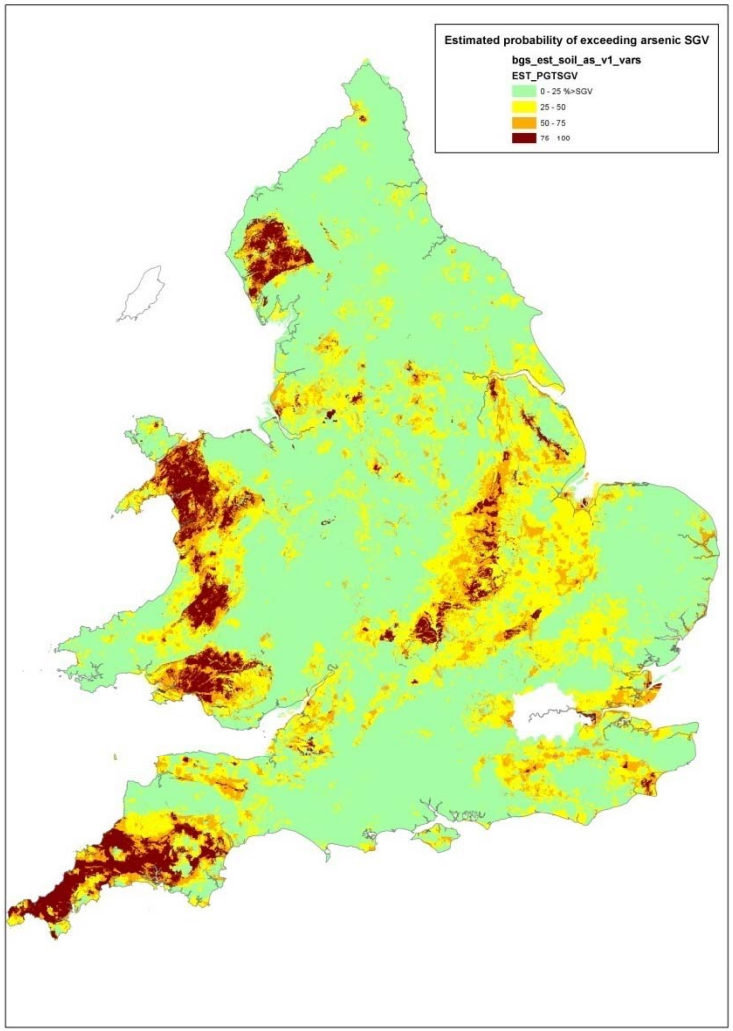
Sources of Airborne Particulates



Probability of Exceeding SGV for As in Soil





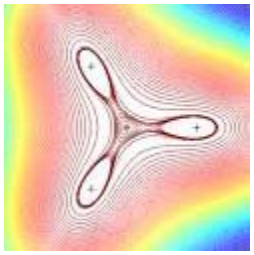
Recent posting on HPA web site

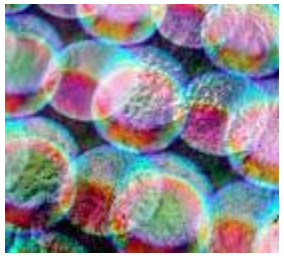
- **Long-term Exposure to Air Pollution: Effect on Mortality Invitation for comment**
- The Committee on the Medical Effects of Air Pollutants (COMEAP) published its report on Long-Term Exposure to Air Pollution: Effect on Mortality on 18 June 2009.
- The report suggests that air pollution has a greater effect on mortality in the UK than previously thought, with a 10 µg m^{-3} increase in fine particles being associated with a 6% increase in risk of death from all causes.

Identifying and Quantifying the source

- We need to know the source and composition of the particulates.
- If it is anthropogenic it might be controlled.
- If it is geogenic this may cause more problems.
- Whatever the source we need tools to understand the processes that contribute to air particulates to aid in human health protection.
- This presentation is looking for geogenic particulate input using a source apportionment approach.

Self Modelling Mixture Resolution SMMR





(Un-mixing the mixture)

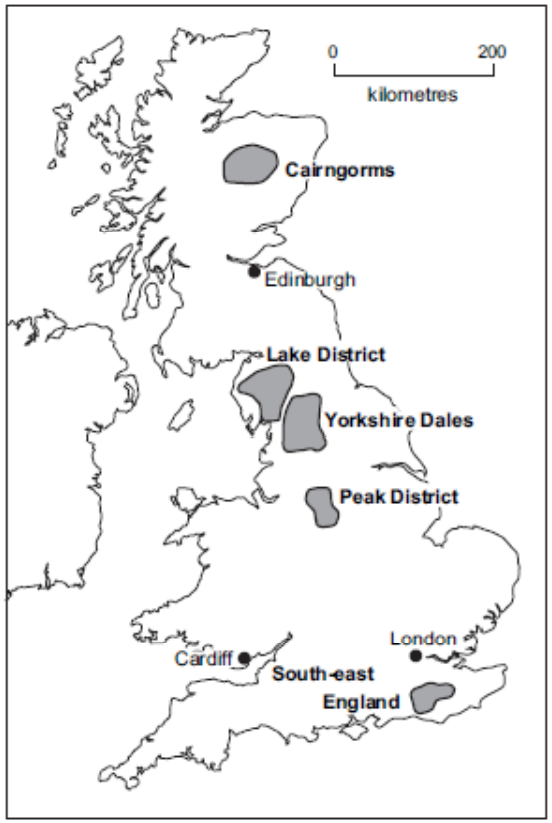
	n elements		c components		n elements		
k samples	**Experimental Data (matrix A)**	=	k samples **Proportions of each component present (matrix B)**	X	c components **Component Compositions (matrix C)**	+	**Error (matrix E)**

CAVE, M R. 2008. The use of self modelling mixture resolution for the interpretation of geochemical data. *British Geological Survey, IR/08/035.*

CAVE, M R, MILODOWSKI, A E, and FRIEL, E N. 2004. Evaluation of a method for Identification of Host Physico-chemical Phases for Trace Metals and Measurement of their Solid-Phase Partitioning in Soil Samples by Nitric Acid Extraction and Chemometric Mixture Resolution. *Geochemistry: Exploration, Environment, Analysis, Vol. 4, 71-86.*

Measurement air particulates over decades
Moss samples

- Moss samples from five UK regions collected over 150 years were analysed for 26 elements using ICP-MS.
- Results for SMMR analysis of Lake district data
- SHOTBOLT, L, BUKER, P, and ASHMORE, M R. 2007. Reconstructing temporal trends in heavy metal deposition: Assessing the value of herbarium moss samples. *Environmental Pollution, Vol. 147, 120-130*.



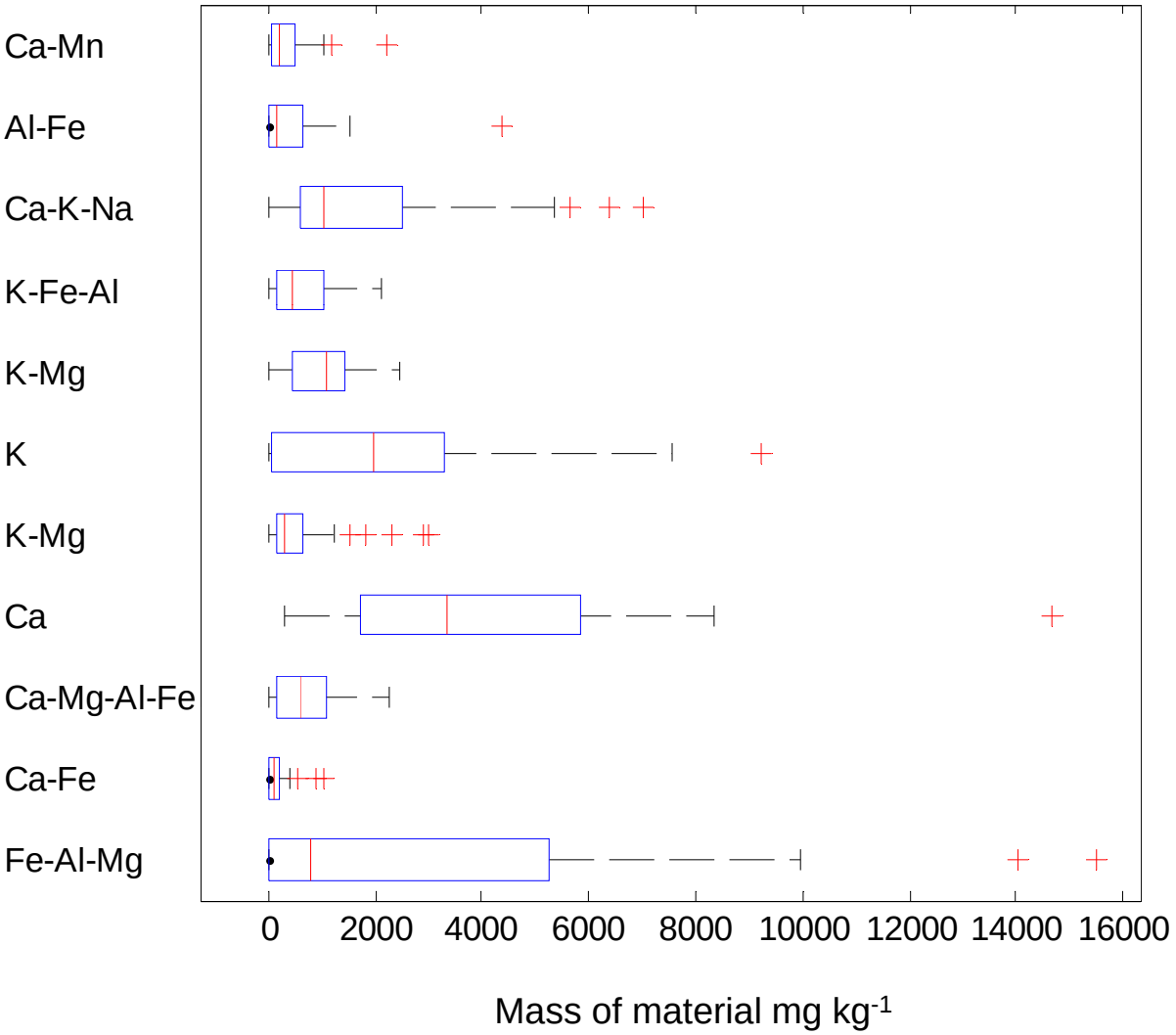

Hylocomium splendens


Hypnum cupressiforme

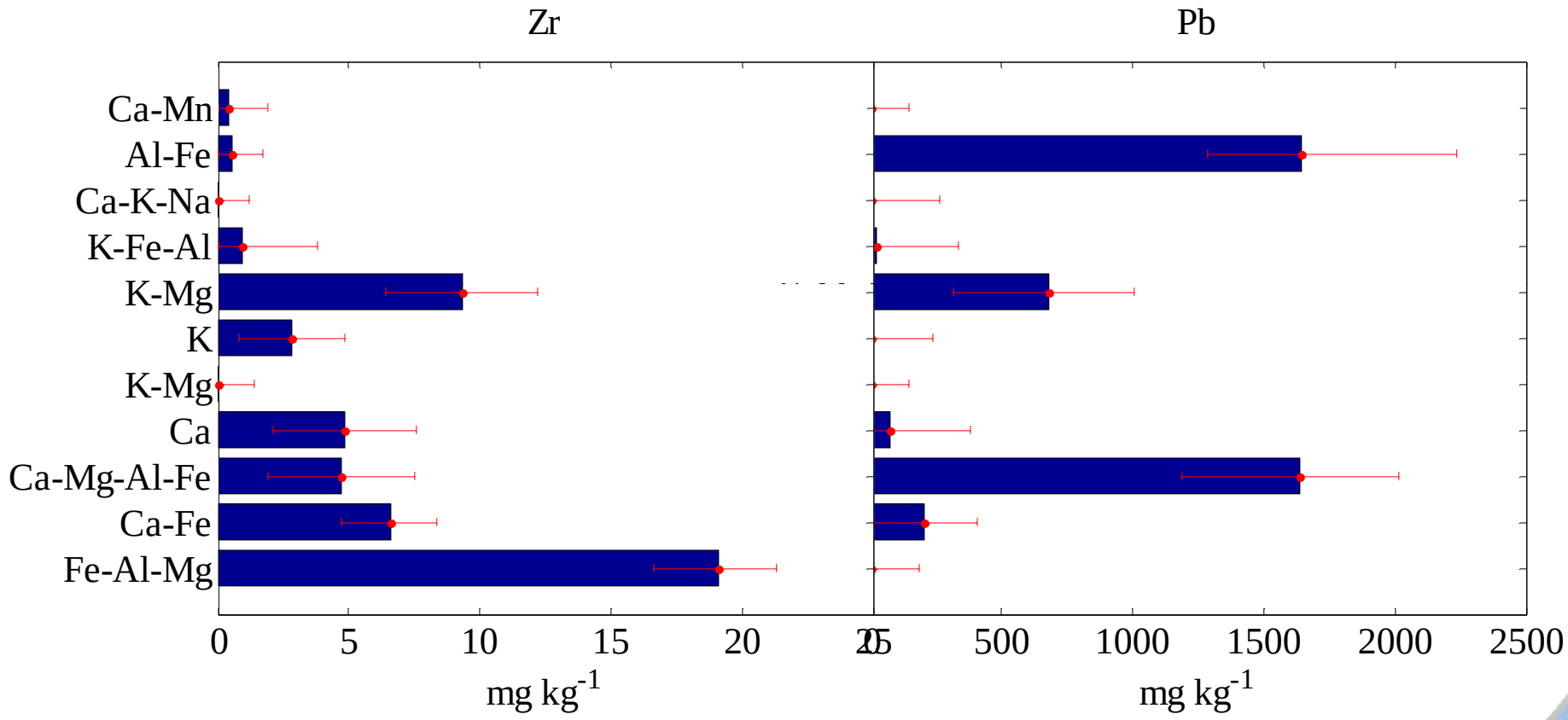

Pleurozium schreberi


Rhytidiadelphus squarrosus

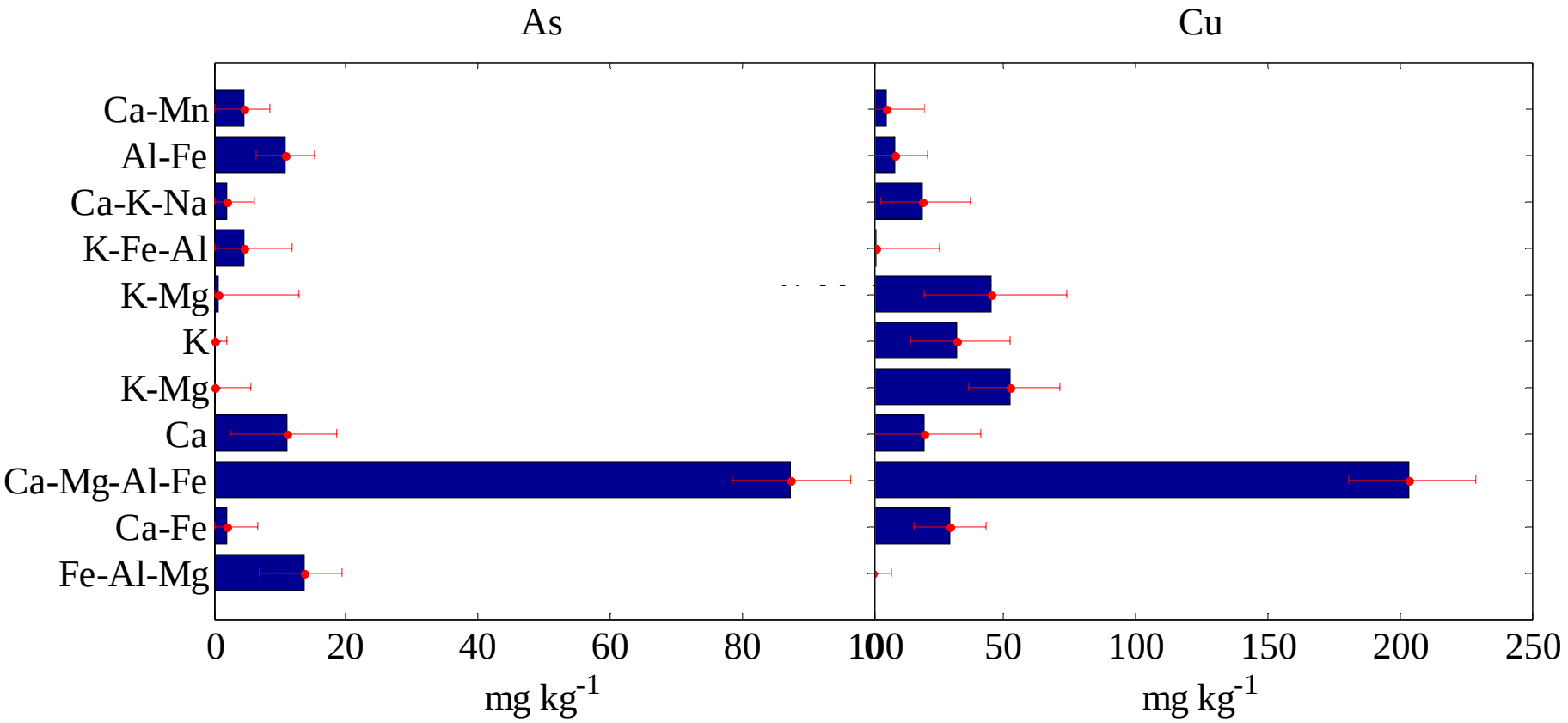
Lake District Samples
(11 geochemically distinct components identified – data from 40 moss samples 1867-1983)



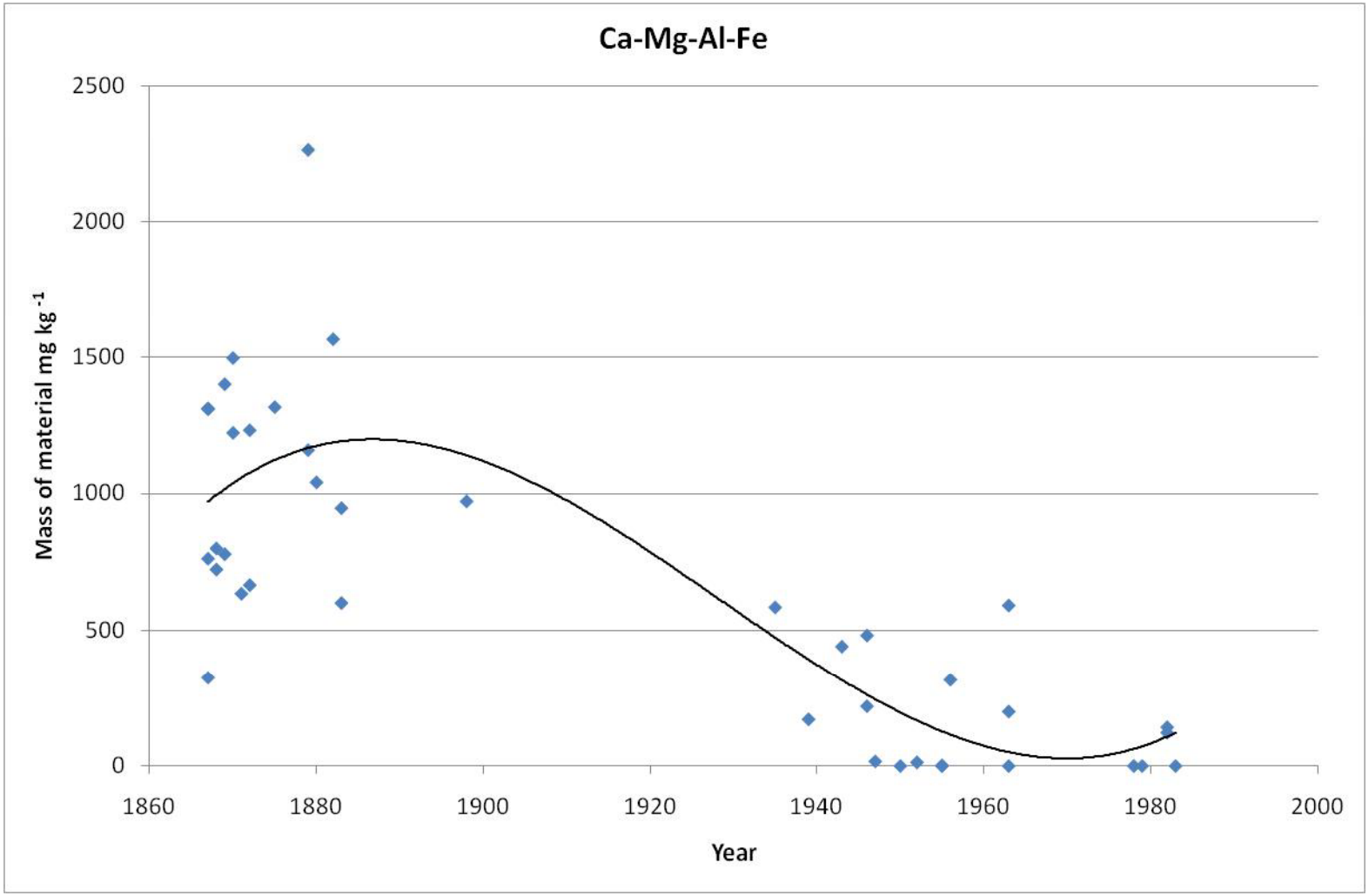
Distribution of Zr and Pb between the components



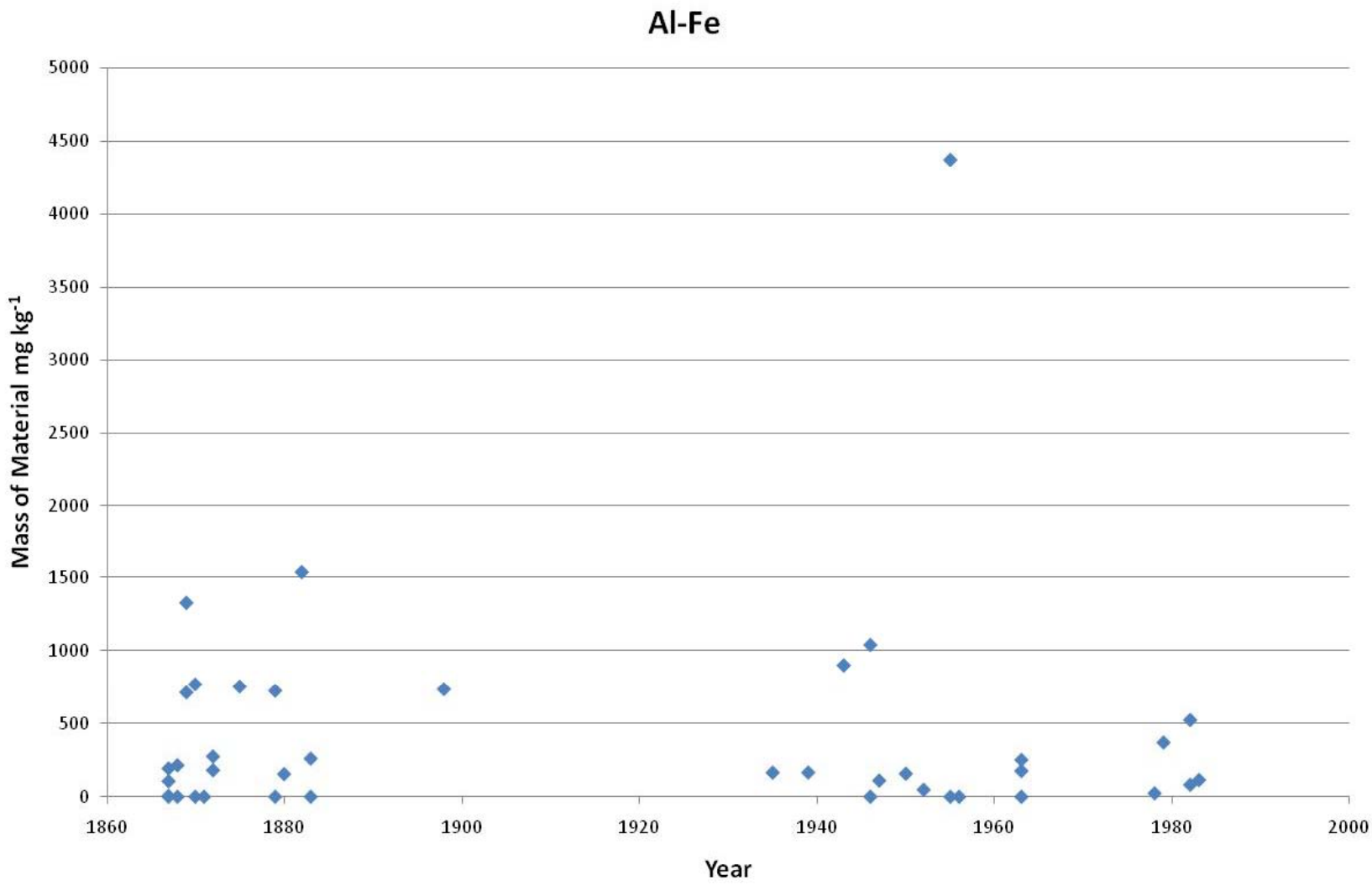
Distribution of As and Cu between the components



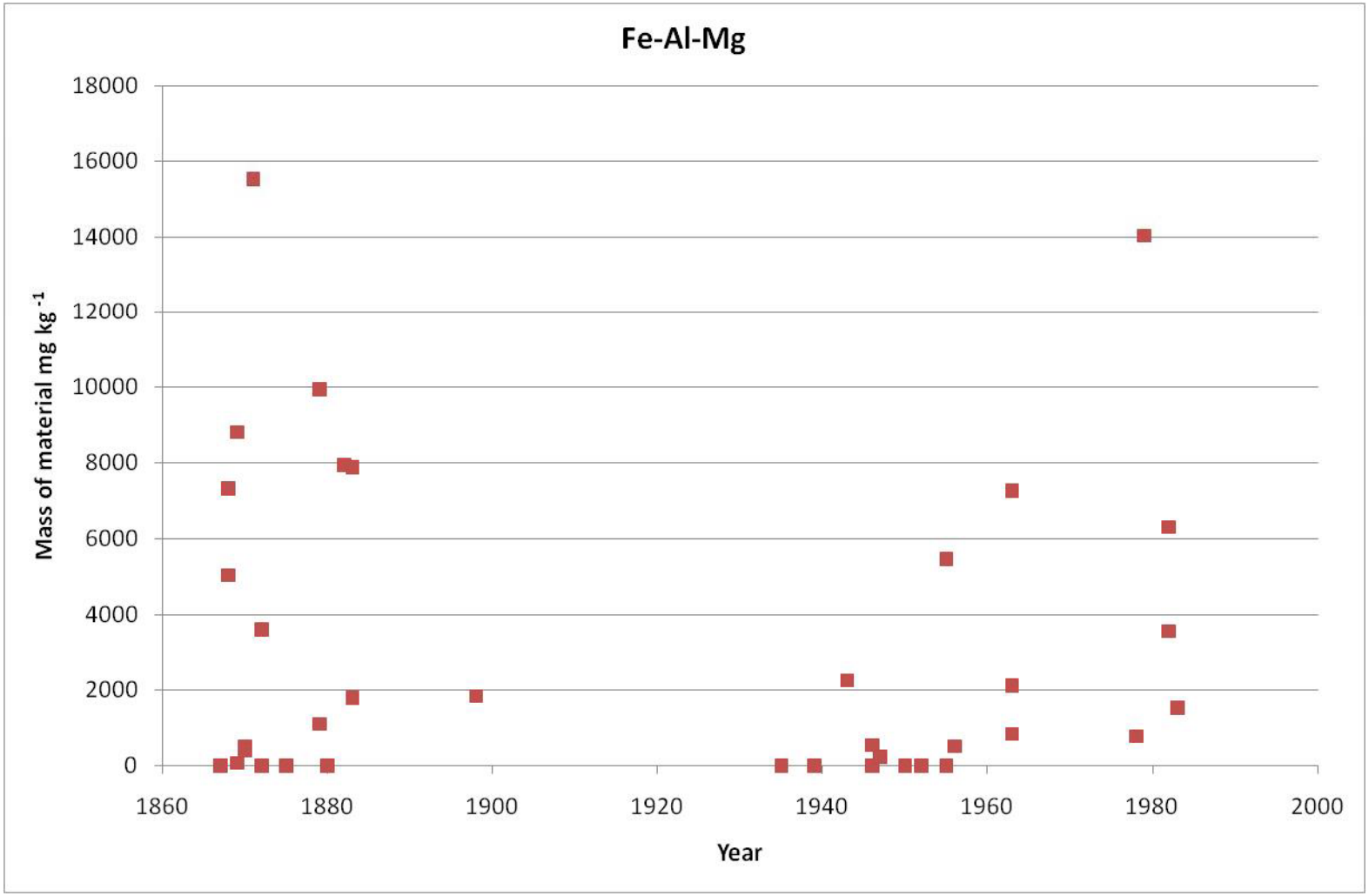
Time Series Plot of the 1st Anthropogenic Component



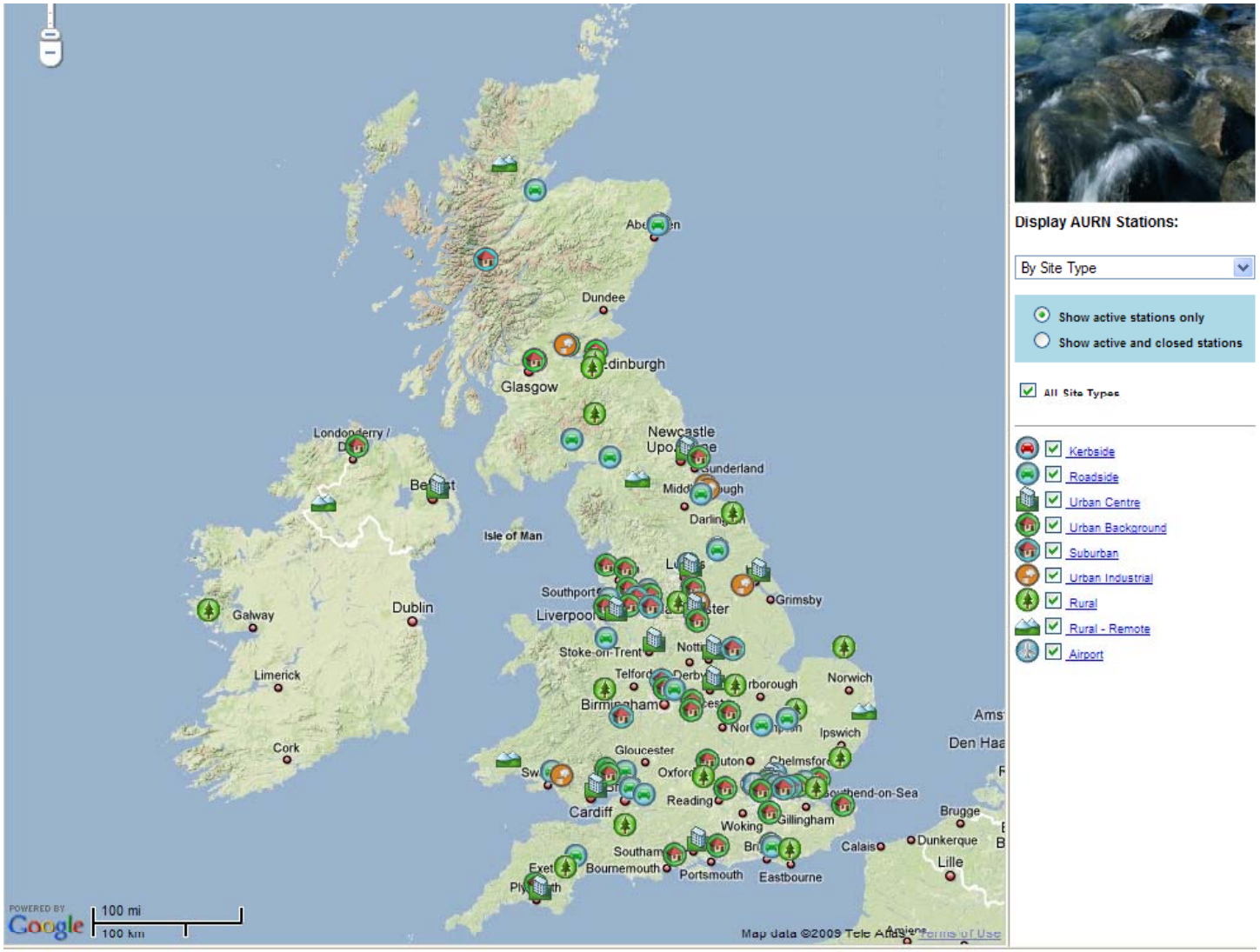
Time Series Plot of the 2nd Anthropogenic Component



Time Series Plot of the Geogenic Component



Measurement of air particulates over days



UK Automatic Urban and Rural Network (AURN) - http://www.bv-aurnsiteinfo.co.uk/

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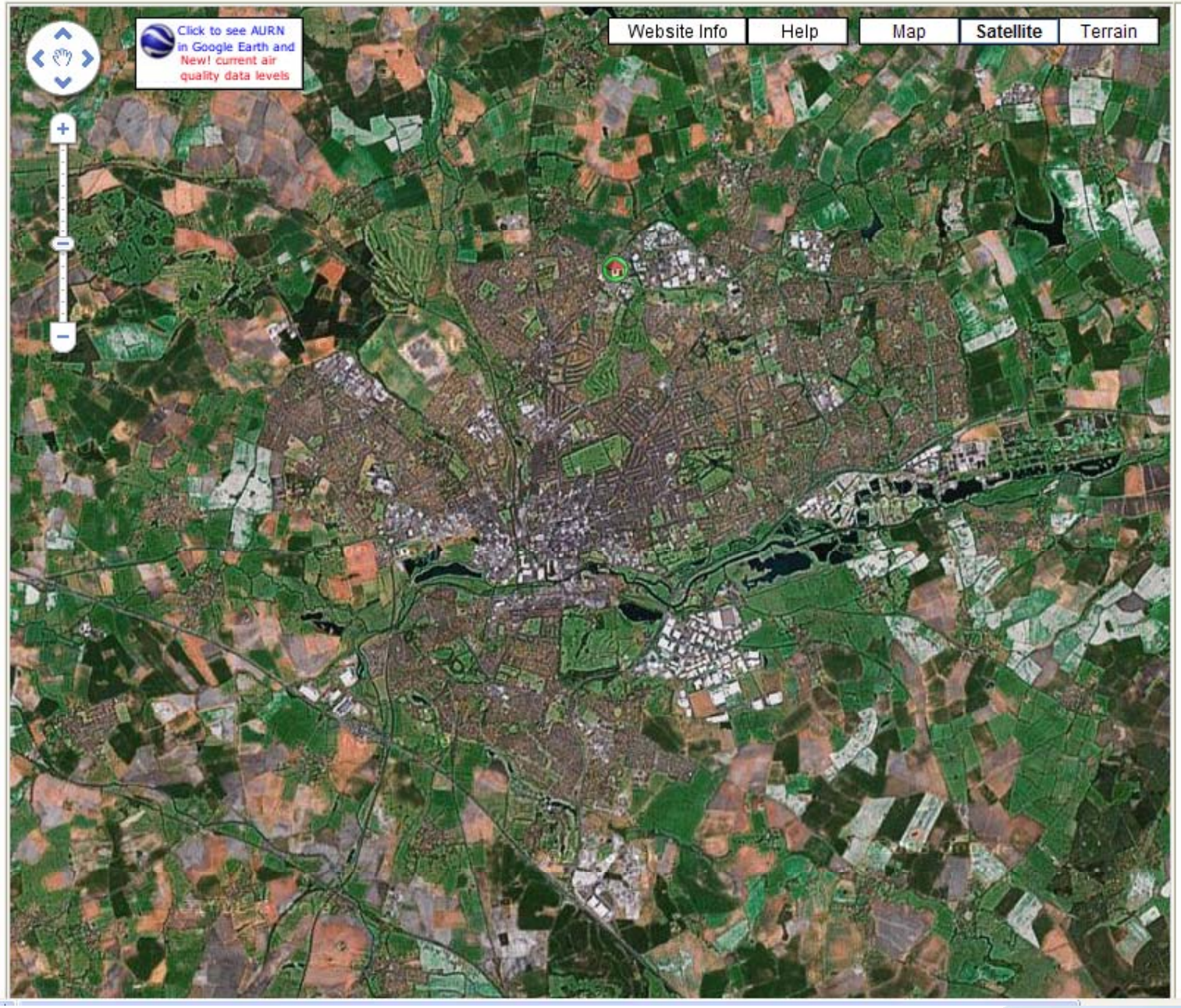
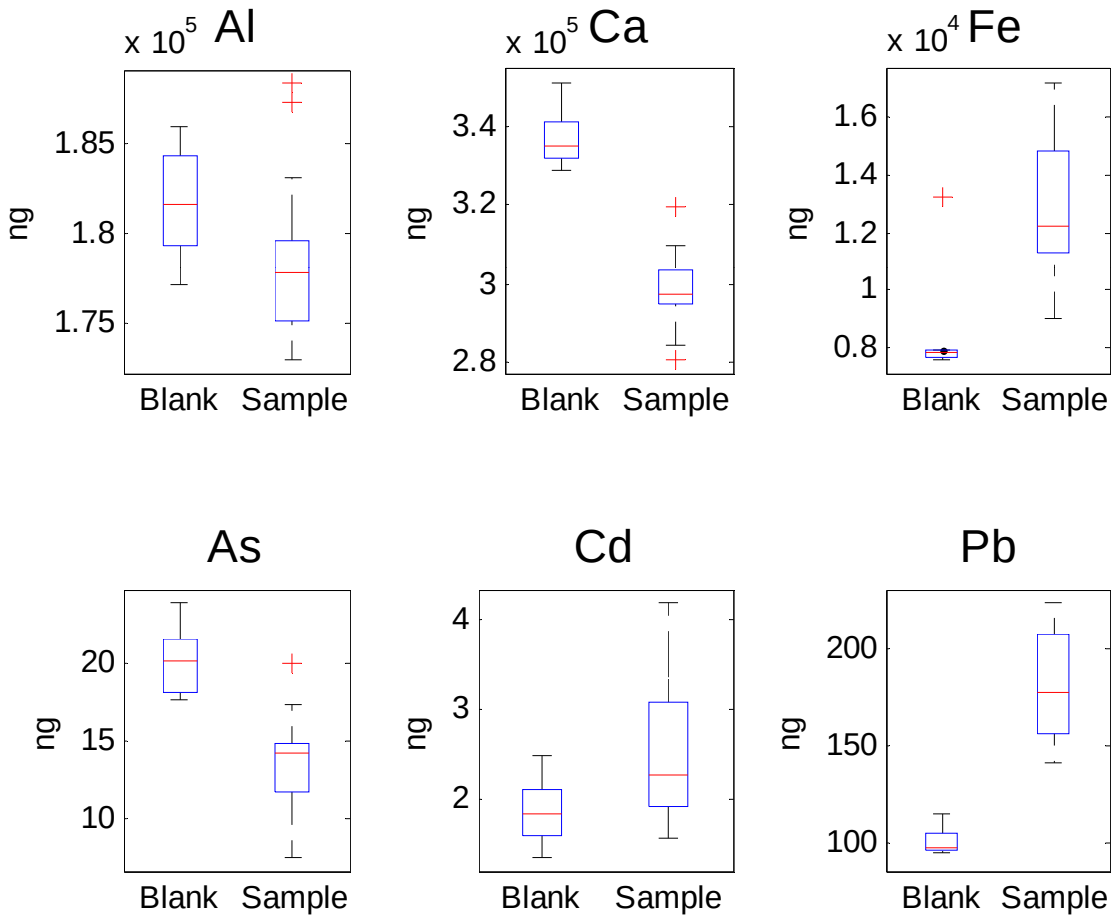


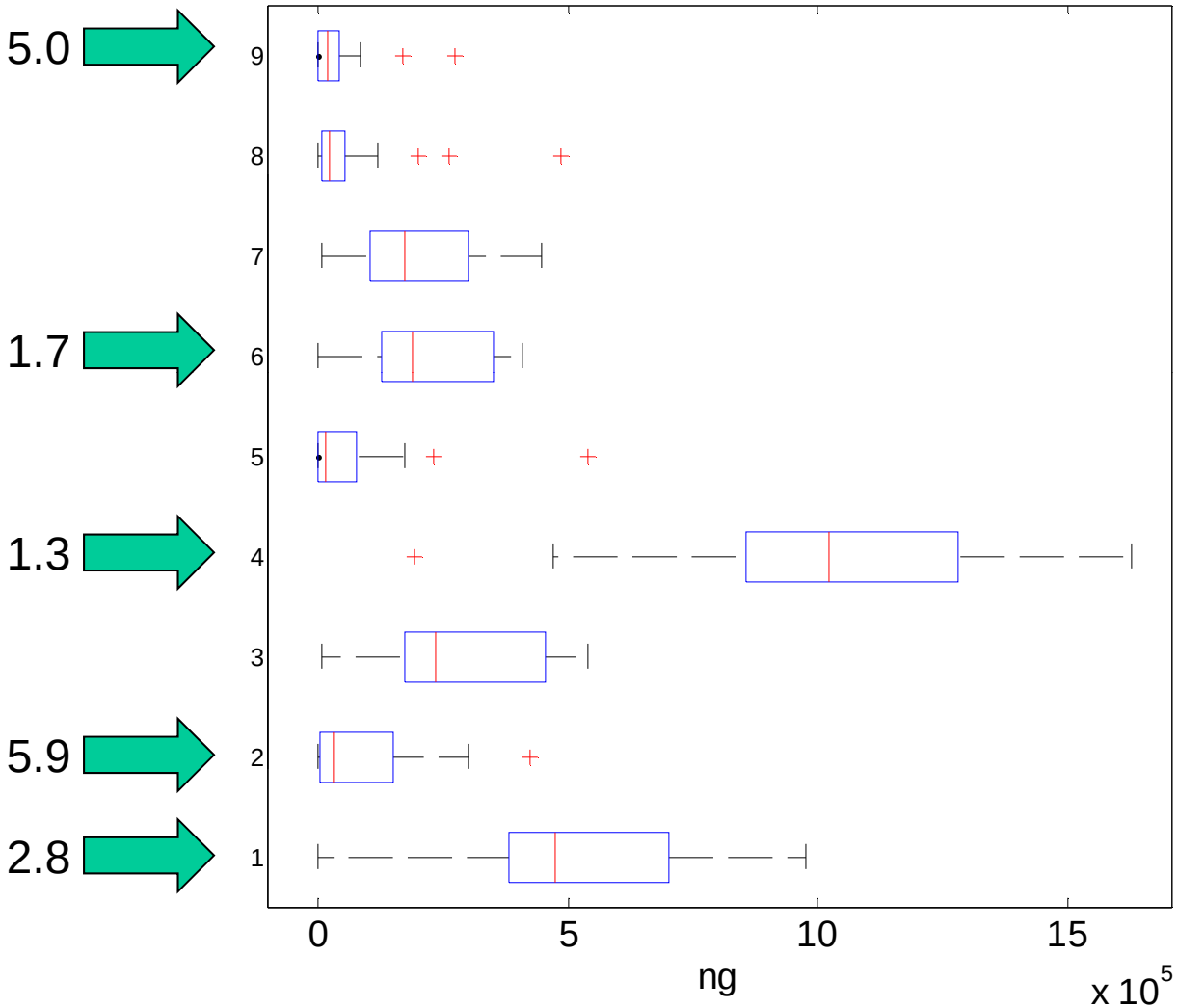
Analysis of Air filters (June 28-11July 2007)

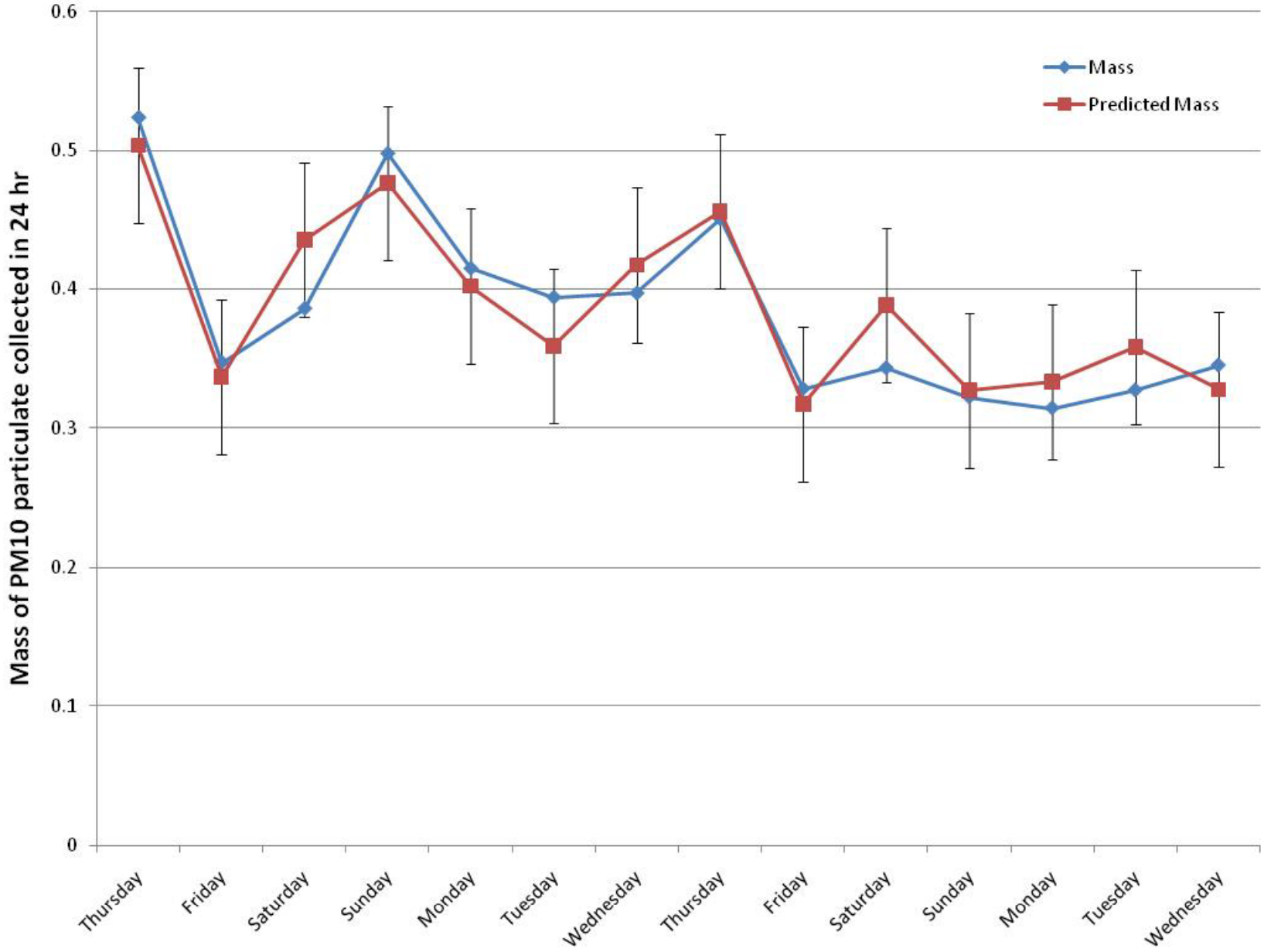
- 14 x 24h air filters and 4 blank filters
- Samples digested by microwave digestion using HF/HNO_3
- Solutions analysed by ICP-MS for 55 elements

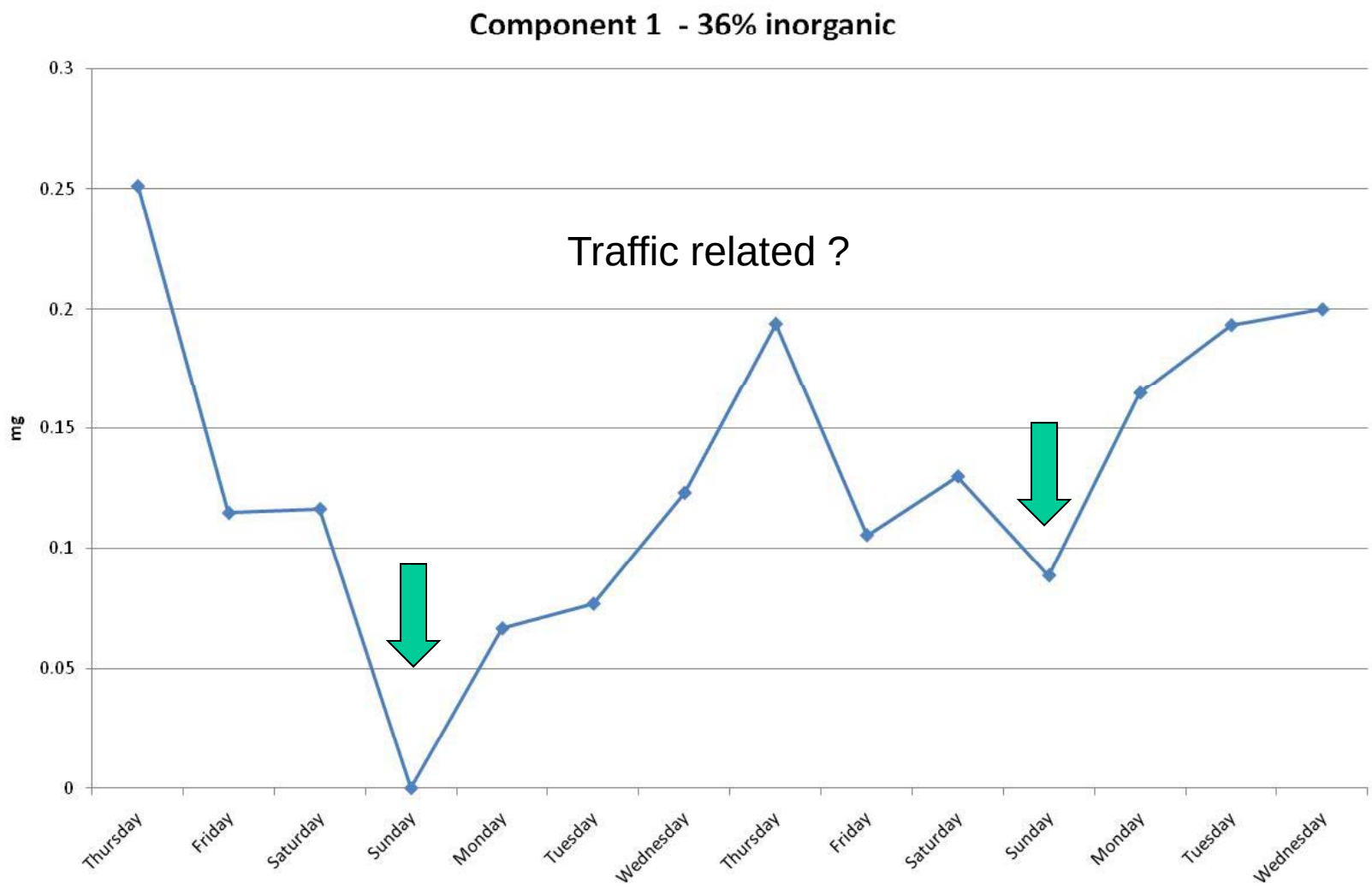
Blank limited Data



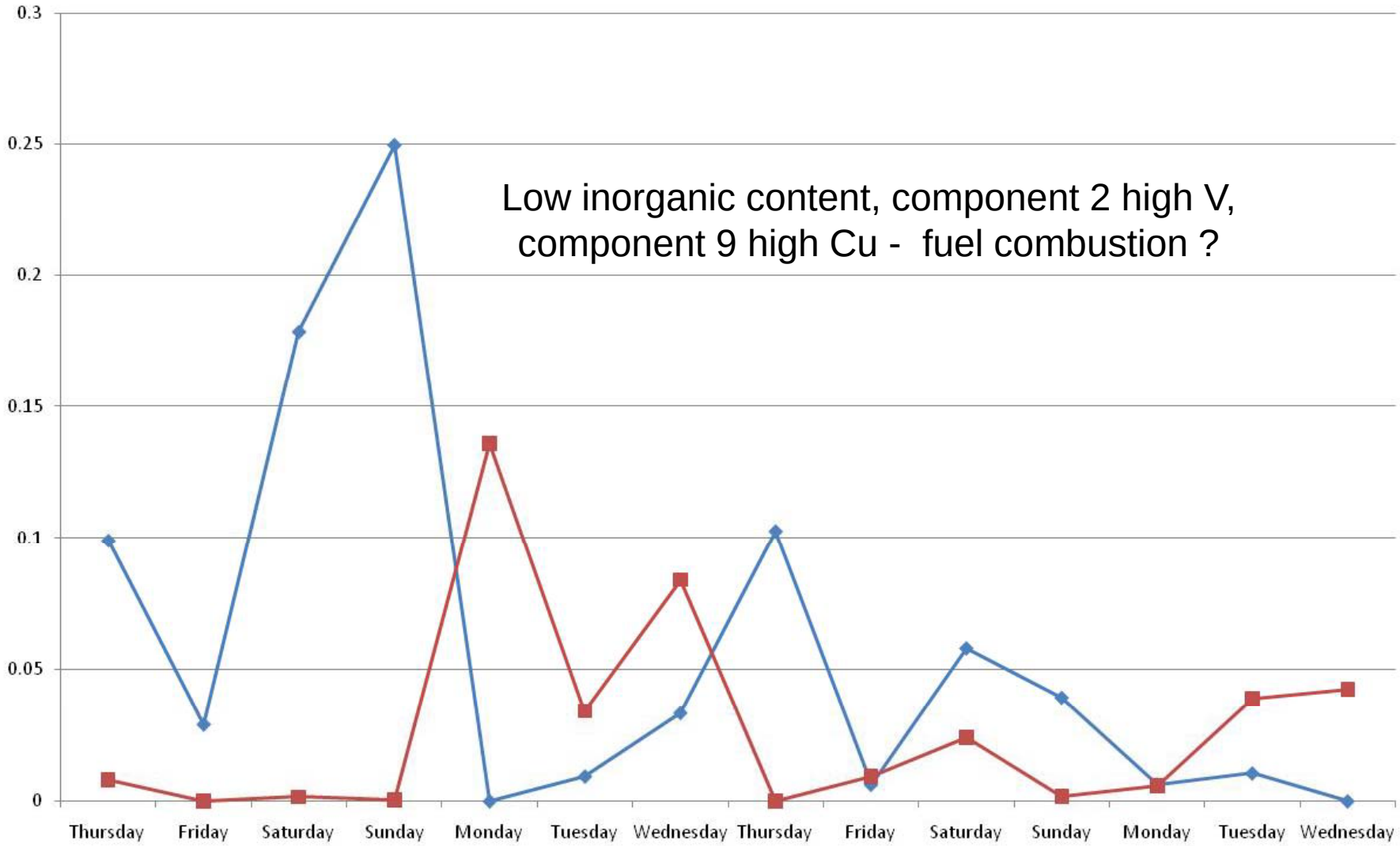
Significant Components and Coefficients



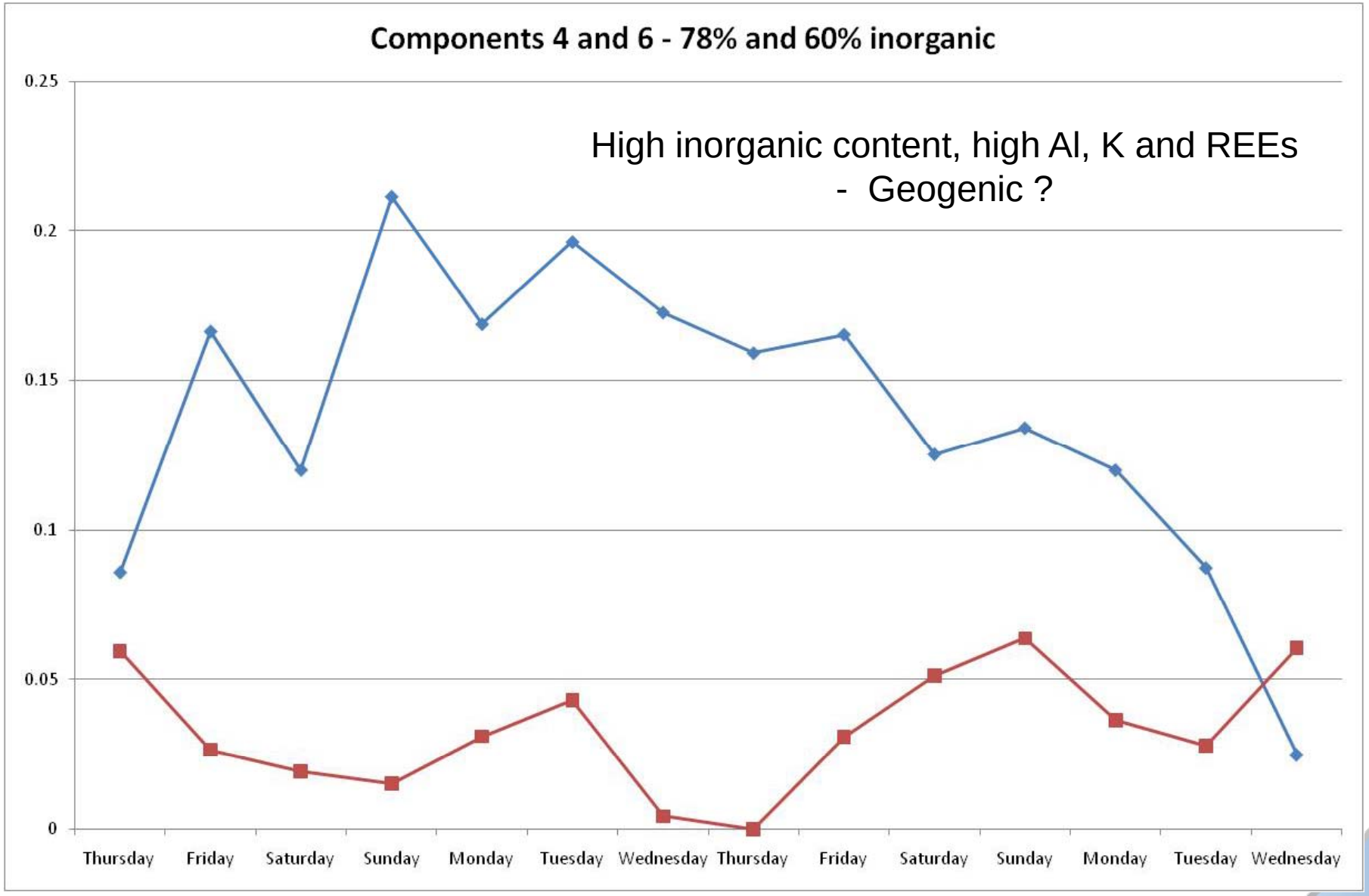


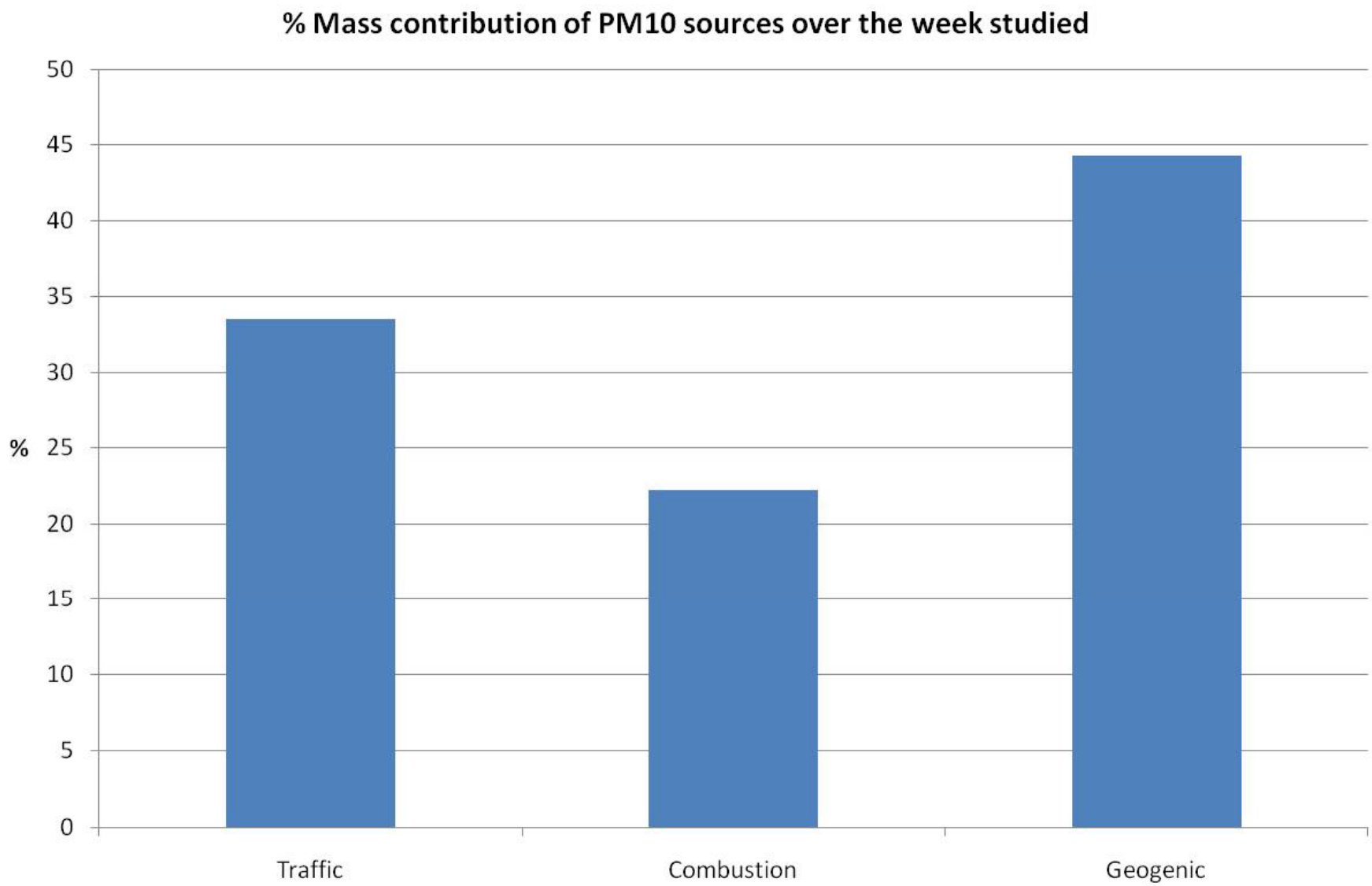


Components 2 and 9 - 17% and 20% inorganic



Low inorganic content, component 2 high V, component 9 high Cu - fuel combustion ?





Conclusions

- SMMR has proved to be a successful tool for air particulate source apportionment in widely different applications.
- Preliminary studies suggest that geogenic inputs to air particulates from the present and last two centuries are significant.
- Comparative studies of present day moss data with nearby air-sampler data may help to validate moss studies.